SAN DIEGO COUNTY

DEPARTMENT OF ENVIRONMENTAL HEALTH

BULLETIN SAN D-16

DESIGN, CONSTRUCTION AND MONITORING OF MOUND SYSTEMS

Effective Date: June 16, 1999

Gary Erbeck, Director

Chris Gonaver, Chief
Land and Water Quality Division

03/16/01

TABLE OF CONTENTS

ATTACHMENTS

1. "Application to Construct a Mound System" (LWQ-M01)
2. "Supplement to the Application to Construct a Mound System" (LWQ-M02)
3. "Mound System Construction Permit" (LWQ-M03)
4. "Mound System Operational Permit" (LWQ-M04)
5. Permit Processing and Approval Flow Chart
6. "Easement Agreement"
7. Appendix "A": Sewage Effluent Pump Requirements
8. Sump/Pump Drawing # 1
9. Sump/Pump Drawing # 2
10. Appendix "B": Mound Detail (Cross Section)
11. Appendix "C" Mound Detail (Plan View)
12. Appendix "D": Purge Valve & Balancing Valve Detail
13. Appendix "E": Monitoring Well Detail
14. Appendix "G": Effluent Movement Models
15. Appendix "H" Guideline for Vegetation
16. Table V Nanograph
17. Worksheet for Design Calculations

SAN DIEGO COUNTY
DEPARTMENT OF ENVIRONMENTAL HEALTH

BULLETIN SAN D-16
(Effective June 16, 1999)

DESIGN, CONSTRUCTION AND MONITORING OF MOUND SYSTEMS

REFERENCE SAN DIEGO COUNTY CODE (SDCC), CHAPTER 3, SECTIONS 68.301 et seq.

01.01 Introduction

San Diego County has a variety of well-defined soil types described in the United States Department of Agriculture Soils Survey (December 1973). The hydrogeology can be summarized with three distinct areas as follows:

Coastal: C*enozoic* sediment ranging from conglomerates to claystones. Perched water conditions are commonly observed. A typical example is the *Torrey* Sandstone underlain by *Delmar* clay. The *San Diego* Formation in the South-Bay usually has a deep clay overburden. Meta-volcanics appear in the coastal areas of Elfin Forest, Rancho Bernardo and Otay Mesa. *Poway C*onglomerate is common in the San Diego River valley and to the area northward of that valley. Vertical seepage pits are typically used where the groundwater is degraded beyond 1500 mg./l. Total Dissolved Solids.

Central: M*esozoic-Paleozoic* metamorphic-granitic rocks (usually weathered decomposed granodiorite at the surface) as part of the *Peninsular Range* of the southern California batholith. The bedrock, although locally fractured, is considered relatively impermeable with depth. The thickness of residual soil varies from less than a foot adjacent to bedrock outcrops to a depth of approximately 20 feet. Typical soil depth is irregular and undulating. Most of these soils can be characterized as a sandy loam and have good percolation. A serial leach field on the contour is usually acceptable for onsite disposal of wastewater. Most of these systems are on the order of 360 to 420 linear feet. Horizontal seepage pits (80 to 100 feet in length) are used in instances where there is insufficient area for a leach field.

Desert: *Colorado* desert sands predominate. Onsite disposal of sewage is typically a septic tank and two pit-liners. The high desert often has a rapid percolation in highly weathered granodiorite.

Rarely can a conventional leach field or pit not be approved for onsite disposal. Acceptable areas for onsite disposal are usually found somewhere on the property with minimal constraints. As a result of options such as pumps, horizontal pits, steep slope construction, and the flexibility inherit with serial systems that can follow contours, there has been minimal activity to consider alternatives as is common in other parts of the state.

An exception to this general case is in the Valley Center central basin where high groundwater conditions have impacted a large area. A construction moratorium in this basin was invoked on October 7, 1980. There have been other high groundwater areas identified in the county as a result of agriculture and imported water.

01.02 Design Criteria for Mounds

The design of mound systems is based on the work by the University of Wisconsin Small Scale Waste Management Project (SSWMP). The primary reference is *The Wisconsin Mound Soil Absorption System Siting, Design and Construction Manual,* Converse and Tyler, (1990). Other sources consulted for this *SAN D-16* included the Sonoma County Public Health Department *Guidelines and Regulations for Non-Standard Sewage Disposal Systems,* (1993), the *1998 Draft California State Water Resources Control Board Guidelines for the Design, Installation, and Operation of Mound Sewage Disposal Systems,* and other recent literature from the SSWMP.

01.03 Type of System

The Mound System is an alternative to conventional septic systems such as leach fields and pits. The mound functions as a single pass sand filter using engineered and natural soils. The system consists of a septic tank, a pump or dosing chamber, and the mound structure.

01.04 Purpose

In order to provide an option to owners who have unbuildable lots using conventional septic systems due to high groundwater and/or unacceptable soil profiles, the County of San Diego has developed these requirements for an alternative onsite disposal system.

01.05 Authority

San Diego County Ordinance 3061; San Diego County Code (SDCC), Chapter 3, Section 68.301 *et seq.* (Septic Tank Ordinance) provides both broad and specific powers to the Health Officer for regulation of sewage disposal in order to prevent public health hazards and conditions that could be a public nuisance.

01.06 Property Owner Warning

Property owners are cautioned that regulations for mound systems may change by actions of the Regional Water Quality Control Board (RWQCB), the State Water Resources Control Board (SWRCB) or the DEH. Therefore, despite previously performed and accepted work by the DEH, any proposal for a Mound System must meet the regulations and standards *in effect at the time* the DEH grants final approval to the "*Mound System Construction Permit"* (LWQ-M03).

01.07 Restrictions on Use of a Mound System

The technology used in a mound system is constantly evolving and changing as new technical information is gathered and assessments are made from the monitoring programs. This can result in discretionary changes as allowed in Sections 68.350 and 68.351 of the SDCC.

01.08 Mound Systems Prohibited

Mound systems are prohibited in all areas of the County of San Diego except as specified on a map of the Valley Center Community Plan. This information is on file with DEH.

Mound systems are prohibited on lots that have been filled, excavated, ripped, plowed, altered, or otherwise modified. This prohibition also extends to areas with flooding, drainage problems, or geologic instability. The DEH may consider variance to this in the case of repairs to a failing septic system for an existing legal residence. Exceptions or variances will not be granted in order to allow increases in flow.

02.01 Construction Permits (See Flow Chart in the Attachments)

A complete "*Application to Construct a Mound System*" (LWQ-M01) and all related elements are required prior to issuance of an approved permit. An approved permit is required prior to beginning construction work of a Mound System. These related elements include the following:

a. Payment of fees for the "***Mound System Construction Permit***" (LWQ-M03) and "***Mound System Operational Permit***"(LWQ-M04).

b. "Easement Agreement" (signed and notarized).

c. **"Supplement to the Application to Construct a Mound System**" (LWQ-M02). (signed and notarized).

d. Technical report and layout from the design consultant.

e. Written acceptance from the property owner for all conditions of the "Mound System Operational Permit" (LWQ-M04).

f. "**Hold harmless" agreement** from the property owner (signed and notarized).

g. Review of the house plans for elevations, number of bedrooms and external construction.

h. Site review of the completed pad and driveway grading (*and*/*or* evaluation of elevations and contours of the approved layout).

02.02 Operational Permit for a Mound System

Mound systems require the issuance and possession of a valid operational permit. When the "*Mound System Construction Permit"* is granted final approval, a "*Mound System Operational Permit*" will be issued. All notarized and signed documents will be recorded with the County Clerk and copies distributed to parties of interest. Operational permits are not transferable.

02.03 Fees and Charges for County Service

The Department will charge the current hourly rate or a deposit for all required services including plan check, consultations, meetings, field visits, inspections, and monitoring. The hourly rate or deposit will be charged until the Department develops experience with mound systems. At that time, a set fee schedule will be proposed for the various elements of the process.

03.10 Easement Agreements

An easement agreement as outlined below must be recorded against the property prior to issuance of a "*Mound System Operational Permit"*.

The purpose of the easement agreement is to allow representatives of the DEH and any other County Officer or inspector and/or the Regional Water Quality Control Board access to the properties for monitoring, testing, or assessment.

a. Easement agreements are for access to the primary and reserve test areas for the Mound System and any area of the property with a setback influence. This includes any area necessary to make an assessment of the Mound System as installed or proposed.

b. Easement agreements may not be removed from the title of the property unless authorized in writing by the DEH.

03.20 Monitoring by DEH

DEH staff shall monitor for groundwater depths and water quality a minimum of twice a year for a minimum period of three years. This monitoring should be in November-December and April-May.

Additional monitoring can be done at the discretion of staff if site conditions are deemed marginal for groundwater separation and/or separation distance is suspected to be compromised.

The costs to the owner will be part of the "*Operational Permit for a Mound System*" fee for two sample sets each year. Additional sampling and costs will be according to the "*Supplement to the Application to Construct a Mound System*" and may include chemical analytes as stipulated in the "*Mound System Operational Permit"*.

03.21 Monitoring and Maintenance by the Owner

The San Diego County Department of Environmental Health (DEH) shall require the mound system to be monitored quarterly or as often as necessary to make an assessment of groundwater conditions and mound operation. This information will be used in fact-finding for continuance of a "*Mound System Operational Permit*". Monitoring requirements are part of the agreement in the "*Supplement to the Application to Construct a Mound System*" and in the "M*ound System Operational Permit*".

Monitoring forms will be provided by the DEH to the property owner on an annual basis for recording the depth of water in the monitoring wells and other maintenance information such as pumping of the septic tank, flushing, and repairs.

a. Property owners shall submit the written report of monitoring and maintenance to the DEH by the tenth day of January, April, August, and November of the calendar year.

b. If reports are not received by the 10^{th} day of the month following the quarter, the County may do the monitoring and maintenance either in collaboration with or through an independent contractor.

c. Costs may be billed to the property owner at the current hourly rate for all time involved in addition to cost for outside contracting. Tax liens or other legal remedy may be used for cost recovery.

d. DEH may modify the monitoring and testing requirements at any time it is determined to be in the public interest.

03.22 Revocation of Mound System Operational Permit

The permit will be revoked if:

a. Fees are not paid as agreed.
b. Monitoring or maintenance is not performed as required

03.23 Reinstatement of a Revoked Permit

Reinstatement of a revoked permit may require some or all of the following:

a. Reinstatement of the "*Mound System Operational Permit*" after costs assessed to the permittee equal to a new permit fee and/or charges as described in paragraph (d) are paid and all requirements in the "*Mound System Operational Permit"* are found to be in agreement with the notarized and recorded "*Supplement to the Application for Construction of a Mound System"*.

b. An administrative hearing shall serve as a forum for appeal by a property owner if there is a disagreement in the finding of fact by DEH as communicated to the property owner as the basis of cause for revoking the "*Mound System Operational Permit "*.

c. An assessment and/or billing will be made to the property owner for all costs necessary to remedy the permit status. This includes costs for administrative time, repairs, pumping, and related costs for attorneys, contractors, consultants, testing, sampling, and DEH staff time. Costs will be assessed as described by paragraph (d).

03.24 Maintenance of a Mound System

a. Septic tanks and sumps should be periodically inspected and checked for signs of leakage and groundwater intrusion.

b. Septic tanks are to be pumped when the sludge layer exceeds 18 inches from the bottom and as follows:

    1. Septic tanks shall be inspected annually by a licensed septage hauler.

    2. Septic tanks shall be pumped according to the requirements of the "*Mound System Operational Permit"*. This will vary according to the number of bedrooms and flow.

    3. Septic tanks shall be pumped by a licensed septage hauler.

c. Disposal of any material into a septic tank other than sewage is unlawful.

d. Vegetation that interferes with the function of a sewage disposal system shall not be planted in any area of the Mound System (See Appendix H).

e. Disking, ripping or plowing of the soil in a manner that will adversely impact the function of the sewage disposal system and/or reserve area shall not be allowed.

f. Property owners are required to notify DEH of any malfunction of the mound sewage disposal system.

g. Maintenance of all surface and subsurface drainage and improvements shall be the responsibility of the homeowner.

h. Property owners are responsible for preventing disturbance to the soil cover by animals, vehicles, structures, etc.

i. Property owners shall prevent hydraulic overloading by routine maintenance of plumbing to prevent leaks and by not exceeding the design flow for single family dwellings.

03.30 Monitoring Well Sample Indicating Failure

A sample result exceeding 240,000 Most Probable Number (MPN) total coliform bacteria and/or having *any* thermal tolerant fecal coliforms is deemed to have an adverse effect on subsurface water.

a. Such level of contamination as sampled from any purged monitoring well located 25 feet or greater downgradient from the disposal field indicates a failing system (unless the background data of upgradient monitoring indicates equivalent contamination).
b. Other parameters such as nitrate and TDS increases will also be evaluated for impacts on the groundwater. Correction measures will be determined by DEH.

03.31 Monitoring Well Sample Indicating Marginal Operation

Sample results exceeding 3,000 MPN but less than 240,000 MPN total coliform and/or no presence of thermal tolerant fecal coliforms exceed the maximum contaminant levels. However, these results define a mound system as operating marginally when:

a. The contaminant levels are results of samples that have been taken from any purged monitoring well located 25 feet downgradient from the disposal system (unless the background data of upgradient monitoring indicates equivalent contamination).

b. Effluent is within 12 inches of the ground surface but does not exceed the total coliform MPN or have the presence of thermal tolerant fecal coliforms.

03.32 Failure of a Mound System

A Mound System that causes sewage to surface or discharge at ground level is deemed to have an adverse effect on surface water and is considered a public health hazard. It is defined as a failing sewage disposal system. Such a system shall be immediately corrected or abated according to the requirements of Section 68.311 of the SDCC and Section 17920.3, Division 13 of the State Housing Law.

04.01 Monitoring Well Locations (See Appendix C)

All mound systems must be designed with a series of monitoring wells to monitor water levels and sample for potential subsurface groundwater degradation. Monitoring wells are placed upgradient, laterally, and downgradient of all mound systems as follows:

a. Two monitoring wells shall be installed downslope side of the sand toe of the mound at equal distant locations from the centerline (e.g. 6-10 feet from each end or midway from the centerline and the ends of the mound).

b. Two monitoring wells shall be installed 25 feet downslope of the sand toe of the mound at proportionate locations from the centerline. Depending on site conditions, additional monitoring wells may be required.

c. One monitoring well shall be installed 10 feet upslope of the sand toe of the mound centerline for sloping sites. If the terrain is level, the monitoring well shall be placed 25 feet from the "upside" edge of the sand toe of the mound.

04.02 Monitoring Well Permits

Well Permits are inclusive and part of the "*Mound System Construction Permit"*. A well permit *is required* for destruction of monitoring wells that are part of a mound systems. All destruction work must be done by a licensed and bonded C-57 well drilling contractor.

04.03 Monitoring Well Construction Standards (See Appendix E)

These wells shall be drilled after the mound is completed and plotted on the construction plan with the correct location. The installation of these wells must be completed under the supervision of, and certified as to their construction, by the design consultant who is either a California Registered Civil Engineer, Environmental Health Specialist or Registered Geologist.

a. The monitoring wells shall have a number identification and site reference for purposes of tracking and data management.

b. Monitoring wells shall be protected and encased in a security structure that can be properly secured to prevent unauthorized access.

c. The well head must be fitted with a watertight well cap.

d. The surface seal shall consist of a minimum of 18 inches of cement underlain by 6 inches of bentonite. This will represent a minimum well seal of 24 inches.

e. The well screen shall be 2 to 4 inches in diameter (PVC pipe, 0.20 screen size) and shall start approximately 6 inches below the bentonite seal and extend to the maximum depth of the bore hole.

f. The sand pack material extending from the bottom of the bentonite seal to the bottom of the bore hole shall consist of #16 uniform sand and is adequately developed during placement to allow the sand to properly settle.

g. All bore holes prior to installation of the monitoring wells must be scarified so as to remove compaction or smearing that may have occurred during drilling of the well.

h. The use of a backhoe for constructing a monitoring well is not permitted.

04.04 Monitoring Well Depth

Monitoring wells shall be constructed to a maximum (10) foot depth *or* to a depth two (2) feet below the discovery of groundwater unless refusal is discovered at consolidated rock or an impervious formation. The casing shall be slotted from the bottom but no closer than thirty-six (36) inches from the ground surface.

04.10 Monitoring Probes (See Appendix C)

A minimum of two (2)-monitoring probes to the bottom of the gravel bed shall be constructed within the mound in proportionate locations in order to observe the level of effluent in the mound structure. These probes shall be installed during construction of the distribution bed.

04.20 Site Criteria for Mound Systems

Site and soil evaluations for each proposed site must be done according to the DEH Percolation Test Policy and these guidelines.

04.21 Site Evaluation

[1]Site evaluations may include but not be limited to the following:

a. Soil profile evaluations.
b. Topographic layout.
c. Groundwater determination tests.
d. Percolation tests.
e. Grain size analysis at the depth of the slowest percolation rate.

[1] Site specific conditions may require other soil tests e.g. plasticity index, evaluation of the slope stability, etc.

04.22 Setbacks (Minimum) for Mound Systems

Buildings or Structures	
Upgradient and laterally	10 feet
Downgradient	25 feet
Property Lines and/or Underground Utility Easements	
Uphill and endslope	10 feet
Downhill	25 feet
Water Wells	100 feet
Perennially Flowing Streams, lakes, and ponds	100 feet
Ephemeral Watercourse	50 feet
Ten-Year Flood Elevation	100 feet
Reservoirs as potable water sources [1]	500 feet
Springs, Seepage Areas	100 feet
Cutbanks, excavations, utility trenches, slopes>60% [2]	5:1
Areas of Geologic Instability	50 feet
Public Water Main	25 feet
Domestic Water Line	15 feet
In-ground Pools and Excavations (Downgradient) [2]	5:1 or 25 feet
Well destruction observed by DEH	25 feet
Well destruction *not* observed by DEH	100 feet

[1] *Varies with slope (See State Guideline for Domestic Reservoirs in the SAN D-14) .*

[2] *The lateral and uphill setback from the septic tank and sump to the mound is 15 feet. The downhill setback from the septic tank and sump is 25 feet (measured from the soil cover). The 25-foot setback is a minimum. A 5:1 separation shall be used if the excavation is greater than a five-(5) foot cut.*

04.23 Soil and Site Criteria for the Mound System

Depth to high water table (highest seasonal variation)	48 inches [1]
Depth to bedrock	48 inches [1]
Permeability of the top 48 inches of soil	5 to 120 minutes per inch
Site slopes	maximum of 12.5%
Placement over filled sites	not permitted
Placement over old septic systems	accepted

[1] As measured from the natural soil surface. (See Section 05.01).

04.24 Filled Sites

Importing or relocation of soil on the site to raise the elevation or to change existing soil conditions is considered "filling". The practice of filling a site in the area of a proposed mound system is not permitted. A "technical exception" to this practice can be granted for repairs when a mound is constructed over an existing leach field. This can be argued as disturbed soil with characteristics of fill.

04.25 Sites with Trees and Boulders

Sites with rock outcrops, boulders, large trees, and or numerous small trees are not recommended for mound systems. Proposals to remove boulders, large tree stumps and rock outcrops will not be approved. An isolated tree downslope from the mound may be acceptable.

05.01 Percolation Tests Criteria

Percolation rates greater than one hundred twenty (120) minutes per inch or less than five (5) minutes per inch are not acceptable for design purposes. Testing should be done in both the primary and reserve area in sufficient number and location to make a professional argument for the merits of the site. The number and location of the tests will vary with the soil types and distribution of the rates. Technical planning for the percolation tests should consider the following:

a. Percolation rates shall be done at depths of 12 inches, 24 inches, and 36 inches as measured from native grade and at other depths if deemed necessary to evaluate the site conditions.

b. Minimum acceptable groundwater level is 48 inches from native grade.

c. The rock content (as retained on a #10 Sieve) shall not exceed 50% by volume within the first 48 inches of soil from natural grade.

d. The minimum acceptable depth to fractured rock, impermeable soils (such as hardpan, claypan, and competent rock) is 48 inches from natural grade.

e. The minimum acceptable depth of permeable soil (48 inches) shall extend a minimal horizontal distance of 25 feet downgradient from the edge of the sand perimeter.

05.02 Plot Plan Requirements

a. Four copies of the plot plans are required. The scale shall be 1" = 20 feet. The following items must be included on the mound design plot plans:

1. Lot dimensions
2. North point.
3. Vicinity map
4. Correct address
5. Assessor parcel number
6. Basis of Lot Certification (Subdivision, Lot Split etc)
7. Accurate topographic contours in the area of the mound and reserve area.
8. Location of proposed or existing wells, springs, lakes, ponds, marsh areas, streams and drainage ditches or channels within 150 feet of any portion of the sewage disposal system including the reserve area.
9. Cross-sections of the proposed mound, drainage ditches, etc.
10. Location of existing and/or proposed structures, driveways, swimming pools, patios, retaining walls, paved areas, large trees and cut banks.
11. Location of existing sewage disposal systems and existing and/or proposed easements, water lines, and underground utilities.
12. Location of all percolation test holes (including test holes that failed) profile holes, and soil sampling locations.
13. Designated reserve areas with potential system designs.
14. Complete schematic of the distribution system indicating spacing of the perforations, orifice size, lateral size, and spacing of the trench bed.
15. Cross-section and plane view of the mound system.
16. Cross-sections of the sump detail, including dose counter and alarm system. Specify dose volume and the float setting.
17. Plan view and design of the distribution network including hydraulic calculations for pump sizing.
18. Cross-sections and locations for monitoring wells.
19. Cross-sections for the manifold balancing valve assembly and the purge valve detail.
20. Calculations for the complete sizing and layout of mound pressure distribution.

06.01 Septic System Flow

Minimum sewage flows for single family and multiple family dwellings shall be calculated with 150 gallons per day water use per bedroom. All septic systems shall be sized for peak daily flows. Reductions in flows shall be considered on the merits of technical data and meter information.

07.01 Septic Tanks

a. Sizes and standards

1. Conform to IAPMO standards, *and/or* DEH requirements in addition to the following:
2. All septic tanks shall be watertight by performing a leak test to the satisfaction of DEH.
3. Metal or wooden tanks are prohibited.
4. All septic tanks shall have two-compartment construction with the first compartment equal to twice the capacity of the second compartment and separated by a baffle.
5. An effluent filter at the outlet of the second compartment or in the second compartment, followed by a single compartment pump chamber.
6. All septic tanks shall be a minimum of 1500 gallons or as DEH shall require.

b. Placement

1. Septic tanks shall be installed according to manufacturer specifications.
2. The tank shall be installed level on a solid bed.
3. Soil around the tank shall be compacted.

c. Structural Strength

1. The tanks shall be capable of withstanding anticipated structural loads
2. Septic tanks shall meet all standards of San Diego County policy and guidelines.

d. Access Risers (Optional if the septic tank is less than two (2) feet below grade).

1. A riser shall extend from each manhole cover to a height of two (2) inches below the surface to the ground to allow access for inspection and maintenance of the tank and of sufficient size for removal of the manhole cover.

2. Concrete, PVC, or fiberglass watertight risers that are structurally capable of supporting the backfill soil loading.

3. All risers shall be fitted with airtight durable lids that have a locking mechanism to prevent unwanted entry and to prevent insect and rodent access.

4. Non-integral risers shall be watertight.

e. Septic Tank Connections

1. All connections from buildings to septic tanks shall be made in accordance with the most recent edition of the UPC.
2. The San Diego County Building Inspection Division is the inspecting authority for connections to the septic tank from a dwelling.

08.01 Mound Description (See Appendix B & C)

a. Basal Area: This is the sand/soil interface i.e. the area shown on *Appendix C* as enclosed by B (A + I) for sloping sites and B (A+I+J) for level sites. *Note:* J equals I on level sites. The recommended soil-loading rate is based on soil texture, structure, and consistence for the mound basal area (USDA Soil Classification) with loading rates that range from 0.2 gal. /ft.^{2} /day for silty clay loams with moderate to strong structure of 0.7 to 0.9 gal./ft.^{2} /day for sands with single grain structure. (See Section 08.03).

b. System Configuration (Length and Width): This portion of the system is designed to accept the linear loading rate i.e. the amount of effluent (gallons) applied per day per linear foot of the system along the natural contour. The design linear loading rate is a function of effluent movement *away* from the system and the *direction* of movement away from the system (horizontal, vertical, or a combination). This flow is illustrated as Figure 2 in *Appendix G.* (See Section 08.04 for Linear Loading Rate determination).

c. Distribution System**:** This is a PVC plastic pipe network that receives the pump discharge from the septic tank pump chamber and discharges the effluent through out the sand bed by way of the gravel bed for equal application. Over time, an organic layer develops at the gravel/sand interface.

d. Mound Cover***:*** This is a medium for vegetative cover and protection. Most soil that will support vegetation is acceptable. It's primary function is to shed rainfall from the mound and to all the mound "to breathe" i.e. allow oxygen to diffuse into and below the absorption area. Thick soils also reduce transfer of oxygen. Recommended mound cover consists of sandy loam, loamy sands, and silt loams because they have better oxygen diffusion. Clay, loam, silty clay loam restrict oxygen diffusion. (See Section 08.20 for soil cover features).

e. Monitoring Probes: These are sometimes called observation tubes and are used to observe the condition of the infiltrative surface. They provide easy access to determine if "ponding" is occurring in the gravel bed. (See Section 04.10 and Appendix C).

f. Monitoring Wells: These are observation piezometers and sample tubes placed in strategic areas to allow monitoring of performance standards such as groundwater level, bacteria removal, accumulation of nitrates, TDS, chlorides, and other parameter. (See Section 04.01-04.05).

08.02 Sizing of the Mound[1]

[1] Source: James C. Converse, University of Wisconsin, 460 Henry Mall, Madison, WI 53706, *Mound Systems for On-site Wastewater Treatment and Dispersal*, January (1999).

STEP 1: Conduct a field assessment for site conditions and site-specific data such as percolation testing, and related engineering. (This step assumes a presumptive evaluation and a series of calculations have been done to determine if the site has potential for a Mound System).

EXAMPLE: A proposed 3-bedroom dwelling is assumed to have a maximum flow of 450 gallons per day. The depth of the tillage preparation is (1) one foot. The linear loading rate is 4 gallons per day / linear foot. (In this example, we are considering a percolation rate of sixty minutes per inch). A more conservative linear loading rate of 3-gal/day/linear foot would be a good recommendation because of the high percolation. This more conservative design would have less risk of toe leakage during winter rains or seasonal saturation. In this example (with a 12% slope, the loading rate would be 0.35 gal. /day/ ft.[2] *(See Section 0.803 and reference to the 60 mpi percolation rate.)*

STEP 2: Determine the (Gravel Bed) Absorption Area Width (A) See *Section 08.04* and *Section 08.05* for loading rate information.

A= (Linear Loading Rate / Sand Loading Rate)

Example: (4 gal. /day/lf) (1.0 gal. /day/ft.[2)] *= 4 feet. Six (6) feet is recommended because field experience has shown a less narrow trench is more likely to fail from hydraulic overload.*

A = 4 ft.

STEP 3: Determine the (Gravel Bed) Absorption Area Length (B) where design flow rate is 0.75 gal. /day/capita and occupancy of two persons per bedroom. Flow is therefore (150 gal. /day) (number of bedrooms)

B= (Design Flow rate / Linear Loading Rate)

Example: (450 gal. /day)(4 gal. /day/lf) = 113 ft.

B = 113 ft.

STEP 4: Calculate the Basal Length (*B*) and Width (*I, A*, and *J*). The width is based on the linear loading rate and the soil-loading rate.

For sloping sites (2-12 ½ %):	A + I = (Linear Loading rate / Soil Loading Rate)

For level sites (0-2%):	*I + A + J* = (Linear Loading Rate / Soil Loading Rate)

Example: A + I = 4 gal/day / ft. / 0.35 gal. /day/ft.[2] *= 11.4 feet. (This means the effluent should be absorbed into the native soil within a 11.4 ft. wide area).*

Since A = 4 feet and A + I = 11.4 feet; then I = 11.4 ft. - 4.0 ft. = 7.0 feet (This is without the correction factor. See Step 9).

STEP 5: **Determine the Depth *(D)***: This depth is a function of suitable soil separation depth and site specific limitations. The limiting depth is 48 inches (See Section.04.23 and Section 05.02).

Example: Since tillage depth was 12 inches and the minimum depth of soil to groundwater or impervious formations is 48 inches and the site met these criteria, then:

The mound fill depth, D is 48" – 36" = 12 " ("D" will "always" equal 12 inches because only mounds with one foot of sand above grade are approved in San Diego County).

D = 12 inches

STEP 6: Determine the Depth (*E*): This depth is a function of the surface slope and width of the absorption area (*A*). The absorption area must be level.

Example: For a 12% slope with the bottom of the absorption area level, then:

$$E = D + (0.12)(A)$$

E = 12" + (0.12)(48")

E = 17.76 in.

STEP 7: Determine the Depth (*F*): The depth shall be at least nine (9) inches with a minimum of 6 inches of aggregate beneath the distribution pipe and one (1) inch of aggregate over the pipe. (See Sections 08.05 and 08.06).

F = 9 in.

STEP 8: Determine the Depth (*G*) and *(H)*: The recommended depth for (*G*) is 6 inches and for *(H)* is12 inches. The (*H*) depth is greater than the (*G*) depth in order to provide a crown for run-off from the top of the mound. For narrow absorption areas, 6 inches of difference is not required. Shallow depths allow more oxygen diffusion to the absorption area. (See Sections 08.10 and 08.20).

Therefore: **G = 6 in. and H = 12 in.**

STEP 9: Determine the Down Slope Width (I). For sloping sites, the "down slope" width (*I*) is a function of the mound depth at the down slope edge of the absorption area. The recommended side slope is usually 3:1 multiplied by the down slope correction factor. (See Section 08.09 for the "downslope correction factor").

Example: Using the recommended mounded end slope of 3:1 and the slope correction factor, then:

$$I = 3 (E + F + G) (\text{Slope Correction Factor})$$

I = 3 (17.76" + 9" + 6") (1.57) = 12.86 ft. (after converting inches to feet)

I = 13 ft.

STEP 10: Determine the Upslope Width (J). This is a function of the mound depth at the "upslope" edge of the absorption area. The recommended side slope is usually 3:1 multiplied by an "up slope correction factor" (See Section 08.09 for the upslope correction factor).

Note: For level sites, the slope widths (*I* and *J*) are equal. They are a function of the mound depth at the edge of the absorption area and the desired side slope. (This is usually 3:1).

Example: Using the recommended mounded side slope of 3:1 and the slope correction factor for the side slope as equal to the upslope, then:

$$J = 3 (D + F = G) (\text{Slope Correction Factor})$$

J = 3 (12" + 9" + 6") (0.73) = 4.9 ft. (after converting inches to feet)

J = 4.9 ft.

STEP 10: Determine the Slope Length (*K*): The slope length (*K*) is a function of the mound depth at the center of the absorption area and the desired mound end slope, normally 3:1. Steep end slopes are not recommended if the mound is to be mowed because of safety considerations. "Typical" dimensions are 10-15 feet.

Example: Using the recommended mound side slope of 3:1, then:

$$K = (3) \{ [(D + E) \div 2] + (F + H)\}$$

$K = (3) \{(12" + 17.76") \div 2] + (9" + 12")\}$

$K = 8.97 \approx 9.0$ ft. (after converting inches to feet)

K = 9.0 ft

Step 11: Overall Length (L) and Width (W) of the Mound

$$L = B + 2K$$

L = 113 ft. + 2 (9 ft.)

L = 131 feet

$$W = A + I + J$$

W = 4 ft. + 13 ft. + 5 ft.

W = 22 ft.

In summary, a planar description of this example of a Mound System installed on a 12% slope with a 60 min. per inch percolation rate for a three-bedroom dwelling would be as follows:

The overall dimensions of the mound would be 131 feet long and 22 feet wide. The absorption area within the mound would be 4 feet wide and 113 feet long. The downslope distance from the sand basal area would be 13 feet. The upslope distance from the basal sand area would be 5 feet and the distance from the edge of the basal sand area to the ends would be 9 feet.

08.03 Hydraulic Loading Rate

Percolation Rate, min/inch	Loading Rate, gal. /ft.^{2}/day
Less than 5	Prohibited
5	1.00
6 – 9	0.90
10-17	0.70
18-24	0.60
25-30	0.56
31-36	0.52
37-45	0.45
46-48	0.43
49-60	0.35
61-70	0.30
71-80	0.25
81-120	0.20
Greater than 120	System is prohibited.

08.04 Linear Loading Rate

Linear loading rates are based on subjective variables. If the effluent flow is primarily vertical, a "high" linear loading rate up 10 gal. /day/linear foot may be used. If the flow is primarily horizontal, then the absorption area should be designed to be wide (e.g. a silt loam which can be expected to have slow permeability). This is also the case when there is a shallow restrictive layer or limiting condition such as saturation or bedrock. These conditions require a low linear loading rate on the order of 4 gal. /day/linear foot. This would result in a long and narrow system.

Therefore in cases of limiting condition, e.g., impermeable soil layer or fractured rock is only 48 inches, the linear loading rate shall not exceed 4 gallons/linear foot/day *unless it can be demonstrated wastewater flow will be vertical and horizontal.*

In soils without limiting conditions other than percolation, the Linear Loading factor shall be as follows:

LINEAR LOADING RATE

Percolation Rate, min/inch	Linear Loading Rate, gal. /day. /ft.
5 to 30	10
30 to 60	6
60 to 90	4
90 to 120	4

08.05 Gravel Bed Design

a. Only single distribution beds are acceptable. Dual beds are not allowed.

b. The maximum width of any gravel bed is 10 feet.

c. The depth of the gravel bed shall be 9 inches.

d. Aggregate for gravel beds

1. Three-eighths (3/8) inch double washed pea gravel size to 2.0 inch double washed drain rock can be used as aggregate.
2. The percentage of fines of washed gravel shall not exceed 1% by weight.

e. Distribution piping in the gravel bed shall have a minimum of six inches of gravel beneath the piping and one inch of gravel over the top of the piping.

f. Natural contour

1. The distribution bed shall explicitly follow the natural contour of the ground. The bed must be installed within a tolerance of 0.25 feet (3 inches) vertically per 100 feet horizontally.
2. Distribution beds shall be angled or curved to meet this requirement.
3. The distribution bed shall not be placed in a concave landscape position.

08.08 Reserve Expansion Area

All residential lots require a 100% reserve area for future repairs.

08.09 Sand Fill Area (Sand Basal Absorption Area)

a. Absorption Area: The basal sand fill area shall as a minimum, provide absorption area based on the average percolation rate and the sewage application rate chart. (See Section 08.03.)

1. Ground slopes greater than 1.0% in the area uphill from the edge of the gravel distribution bed shall not be included in the calculations for the required absorption area.

2. Areas beyond the longitudinal end of the gravel bed shall not be included in the calculations for the required absorption area for any system exceeding 1% slope.

b. Configuration The toe of the sand fill shall follow contour, and shall not deviate more than 0.25 feet (3 inches) in elevation per 100 foot run. The sand fill material shall meet the sand specifications of Section 08.10 of this SAN D-16.

1. The sand fill configuration shall extend a minimum of 24 inches from the edge of the distribution bed on all sides, then uniformly slope as determined by the mound dimensions.

2. On slopes greater than 2%, the 24-inch dimension may be reduced to 12 inches (minimum) on the uphill side of the distribution bed only. Slope correction factors shall be applied according to the following:

SLOPE CORRECTION FACTORS		
SLOPE %	***DOWNSLOPE (I)***	***UPSLOPE (J)***
0	**1.00**	**1.00**
2	**1.06**	**0.94**
4	**1.14**	**0.89**
6	**1.22**	**0.86**
8	**1.32**	**0.80**
10	**1.44**	**0.77**
12½	**1.57**	**0.73**

08.10 Standards for a Mound

1 James C. Converse, University of Wisconsin, 460 Henry Mall; Madison, WI., *Mound Systems for On-site Wastewater Treatment and Dispersal*, January (1999).

The purpose of sand in the mound is to provide treatment of the effluent. Sand can reduce the population of coliform bacteria (an indicator organism for pathogens in the wastewater). This treatment occurs in the basal sand and in the unsaturated natural soil. The combination of the basal sand and natural unsaturated soil maintains the five (5) foot separation between the gravel bed and the groundwater or bedrock.

The construction methods used are extremely important and quality of sand is a major consideration. The most critical material component of the installation is the sand media. If the sand that does not meet the standards, it shall be rejected.

Sand standards for a Mound System shall be as follows:

a. Based on a sieve analysis of sand samples, the sand fill should fit between the ranges given in the Table V Nanograph.

   The design consultant and contractor shall test enough samples to certify the mound sand (See section 10.02).

b. The sand shall not have more than 20% (by weight) material greater than 2 mm. in diameter (which includes stone, cobbles, and gravel).

c. There shall not be more than 5% silt and clay (<0.53 mm., 270 mesh sieve) in the fill.[1,2] **Less silt and clay is preferred.**

d. Although Table V gives a range, the recommended specifications for mound sand is the "left curve" (effective diameter close to 0.30 mm and uniformity coefficient of 4.0) and not fine sand as described by the "right curve".

[1] According to the USDA classification, this is a course sand. Note: Other sands can be defined as "coarse sand" and not meet this *Guideline* for mound sand fill. The C-33 specification (ASTM-1984) for fine aggregate does fit within this guideline, but the coarser (>2 mm) and finer (<0.053 mm) fractions must be evaluated to agree with these limits. A sand with an effective diameter (D_{60} / D_{10}) between 4 and 6 meets this criteria when the coarser (>2 mm) and finer (0.053 mm) fractions meet this guideline.

[2] The recommended media for a single pass sand filter is a coarser sand with less fine material, an effective diameter of 0.30 mm, uniformity coefficient of 4.0. 0- 2% passing the 100 mesh sieve and 0-1% passing the 200 mesh sieve. Since the mound *is* a sand filter, the material recommended for sand filters is suitable.

08.20 Soil Cover Features and Depth ***(See Section 08.01)***

The character of the soil cover shall be at least equal in structure and composition as the existing topsoil on the site. The permeability should be in the range of 40-60 min. per inch. The soil cover shall be mounded to a height of 12 inches above the gravel and sand portion of the mound system. Soils that are expansive, massive, or platy (or of high clay content), should not be used because they do not allow the system to breathe, i.e. have effective air diffusion). The conditions can become anaerobic and eventually result in a system failure. A filter fabric is installed above the distribution bed to prevent soil infiltration.

08.30 Width of the Soil Cover

a. Four (4) feet of soil shall extend from each end and from the upslope side.
b. Soil cover shall extend downhill from the toe of the mound a minimum as follows:

SOIL COVER WIDTH

4 feet	**0-2% slope**
6 feet	**2-4% slope**
8 feet	**4-6% slope**
10 feet	**6-8% slope**
12 feet	**8-12 ½ % slope**

08.40 Distribution System

The network distribution system must spread the wastewater uniformly over the gravel bed area. System piping shall be PVC Schedule 40 or equivalent material. The diameter of the distribution piping should be 1¼-inch diameter.

08.50 Total Dynamic Head Loss

Designers shall calculate the total dynamic head loss of the entire distribution system according to the following:

a. Vertical differences.
b. Length of entire piping system.
c. Friction loss of all valves, tees, elbows and appurtenances.
d. Head loss referenced as feet of elevation.
e. Hydraulic orifice discharge shall be a minimum 24" to a maximum of 36" in height if the discharge is downward.
f. Hydraulic orifice discharge shall be a minimum of 60" for upward discharge. Orifices shall be protected (see Section 08.42 c).
g. Orifice spacing shall be a maximum of 36" on center.

08.51 Balancing Valves and Purge Valves (See Appendix D)

System distribution manifolds shall have a balancing valve at the beginning of each perforated pressurized line and a purge valve at the end of each lateral.

a. All valves shall be protected and encased within a plastic, concrete, or other approved type box to provide easy access and maintenance.
b. Box size shall be 10 inches across or larger, round or square, and must allow enough room for maintenance and/or to install stand pipes at the ends of the purge valves.
c. Balancing valves shall be PVC Schedule 80 (minimum) gate valves.
d. Purge valves shall be PVC Schedule 80 (minimum) gate or ball type valves.

08.52 Perforated Pressure Lines

Spacing of pressurized lines shall be based on gravel bed width. The perforated pressurized lines shall be Schedule 40 pipe. The recommended orifice or hole size is 1/8-inch diameter for a 60-inch hydraulic lift. Holes *shall not* be drilled in the field. All holes shall be carefully cleaned out so as to remove any plastic remnants. If a 3/16-inch diameter is drilled, it must have a 24-inch hydraulic lift.

Width of Gravel Bed	**No. of Pressurized Lines**
3-4 feet	**1**
4-6 feet	**2**
6-8 feet	**3**
8-10 feet	**4**

a. Maximum length of pressurized lines shall be 75 feet
b. Maximum distance between perforations shall be 36"
c. If perforations are directed up they must be protected with a protective piping, chamber, or shield.

08.53 Sump and Pump Requirements

Refer to Appendix A and Drawings 1 and 2 of this SAN D-16 for required sump and pump features. All sump and pump systems shall have an effluent filter preceding the pump. This is for the removal of floating debris and suspended solids.

08.54 Dosing

Automatic dosing siphons are **NOT** allowed in mound sewage disposal systems. Short frequent doses allow the effluent to be retained in the sand/soil for longer periods; therefore, timed dosing with user friendly control panels are required.

08.55 Dosing Volumes

Number of Bedrooms	**Dose ,Gal./Pumping Period**
1	**50**
2	**75**
3	**115**
4	**150**
5	**200**
6	**200**

09.01 Designer and Installer Qualifications

a. **Designer**: State of California registered civil engineers, registered environmental health specialists, and registered geologists may design mound systems provided the following criteria have been met:

1. Proof of registration and orientation on file with the SD County DEH.
2. The designer must be knowledgeable of SD County DEH mound system requirements.
3. All professional work shall be within the licensing limitations as required by the Business and Professions Code [1]

[1] *An example of a license limitation is the requirement for a professional engineer to design a pump system.*

Note: Registered civil engineers, registered environmental health specialists, and registered geologists shall place an original signature on all plans, information and certification documents submitted for review. The expiration date of their professional license shall be indicated on all signed reports.

b. **Installer**:

1. Must have an active California contractor's license – Type A or C-42.
2. Must have current verification of Workers Compensation Insurance if any employees will work on the system construction.

10.01 Construction Requirements

a. Requirements for the Construction of Mounds: These specifications must be included in the system plans submitted with the *"Application to Construct a Mound System"*.

1. The use of wheel type vehicles is prohibited as follows:

   (a) For the purpose of ripping.
   (b) When driving on any areas that have been ripped.
   (c) When driving on the sand.
   (d) When placing or moving the soil cover.
   (e) At any time the soil conditions are wet, moist or saturated.

b. Placement of the pressurized transmission line from the sump tank to the mound manifold shall be a minimum of 24 inches below the surface of the ground. Use metallic locating tape for all plastic lines.

c. Site preparation of soil surface to a depth of 8 to 12 inches shall include the following:

1. Mow excessive vegetation, remove trees, cut and grind stumps to a depth of 12 inches.
2. The soil surface shall be ripped or chisel plowed to a depth of 8-10 inches. Initial ripping shall be parallel to the contours of the ground within the limits of the sand base; (rippers set 8 to 10 inches apart).
3. After the first twelve-(12) inches of sand has been placed, rip the native soil/mound soil interface to blend together.
4. Prohibit all traffic on any ripped surfaces until after placement of the full depth of fill or cover material.

d. Uniformly place and compress the sand fill by track rolling to a neat line to the grade determined by the mound dimensions. A tolerance of no more than 0.25 feet (3 inches) vertically per 100 feet horizontally is allowed. Add additional sand as the sand fill area is compressed.

e. Construct gravel bed with special attention to the correct elevation.

   1. Temporary form boards are required for placement of the distribution bed gravel.
   2. Form boards shall be fully enveloped by the sand bed and shall be removed prior to cover placement.
   3. Install the filter fabric.

f. Perform a hydraulic test after the distribution system has been completed.

   1. The pump must deliver the required 24 to 36 inches head to the beginning of each lateral.
   2. Distribution to all laterals shall be equal.
   3. This test shall be observed by the design consultant and a DEH representative.

g. Condition the soil cover material with sufficient moisture to permit track rolling to a firm cohesive surface.

h. Establish the finished grade of the mound by track rolling and grooming by hand. Complete appropriate drainage work and erosion control measures before the final inspection. The purpose of the drainage work is to eliminate ponding conditions due to surface runoff on and around the mound system.

i. Install monitoring wells and details as shown on the approved plans.

j. Landscape or seed the mound soil cover with approved vegetation. (See Appendix H.)

k. Sample all monitoring wells for background water quality analysis. At a minimum, the wells shall be analyzed for Total Coliforms, TDS, Conductivity, Nitrate, Chloride, and Kjeldahl Nitrogen.

10.02 Construction Inspections

General Requirements for Mound Systems: The following construction requirements shall be observed by all parties involved in the system construction.

a. The design consultant shall inspect the site and evaluate weather conditions prior to construction of the system. This is to verify dry and acceptable soil and the weather conditions are suitable to begin construction.

b. ***First Interim Construction Inspection****:* The contractor shall notify DEH a minimum of 48 hours in advance of construction for a pre-construction conference. This meeting shall include the contractor and the design consultant. The proposed system shall be staked out showing the locations of the basal sand footprints, gravel bed, transmission line, soil cover perimeters, all setbacks, proposed location of monitoring wells, tank locations, etc.

c. The design consultant shall provide a written report certifying the layout and staking of the proposed system meets the specified design conditions and the following:

   1. Soil conditions are acceptable for no smearing or compaction during construction.

   2. Weather conditions and a time frame for completion are agreeable so unsuitable soil conditions do not develop during the course of construction.

   3. The source of fill material has been evaluated with adequate sampling by the design consultant in order to provide a written approval of the material to DEH.

d. ***Second Interim Construction Inspection****:* The contractor shall notify DEH a minimum of 24 hours in advance of ripping or plowing and preparation of the soil for construction so DEH can observe the work. This inspection should include the design consultant.

e. ***Third Interim Construction Inspection****:* The contractor shall notify DEH a minimum of 24 hours in advance of sand and fill placement and schedule a joint inspection with DEH and the design consultant to observe a hydraulic distribution test.

f. The design consultant shall provide an as-built map and cross-sections of the mound. These shall show the location and dimensions of all the components of the mound. Additionally, a written certification must be provided stating the materials meet the design specification for the mound used (i.e., the basal sand, aggregate in the gravel bed and the soil cover).

g. ***Fourth Interim Construction Inspection****:* After a request for this inspection from the contractor, DEH will inspect the monitoring probes and conduct a visual inspection of the mound system.

h. ***Fifth Interim Construction Inspection****:* This inspection must include the design consultant and the contractor. After a request for this inspection from the contractor, DEH will check the line and grade of excavations and fill, function and the setting of all control devices such as valves, switches, and alarms. The contractor shall demonstrate a hydraulic testing of the pump, float setting, and the distribution network. **NOTE:** At least 24 hours prior to the inspection, the tank shall be filled with water. During the Interim Inspection, DEH will observe the water level in the tank for an evaluation of watertight integrity.

i. ***Final Construction Inspection****:* A DEH inspector will meet the contractor and design consultant on the site to verify all elements are complete. Final approval will be granted when the design consultant concurs in writing that the system meets the design requirements.

12.01 Definitions

Absorption Area: The area where the sewage disposal system basal sand interfaces with native soil.

Bedrock: Solid rock, which may have fractures, that lies beneath soils and other unconsolidated material. Bedrock may be exposed at the surface or have an overburden up to several hundred feet thick.

Bedroom: Any room designated by the applicant as a "bedroom"; other rooms, such as sewing rooms, dens, offices, studios, lofts, game rooms, etc., may also be considered as bedrooms. Rooms having one or more of the following features may be considered by the Health Officer to not be a bedroom:

a. A large, arched doorway without a door that opens to the entryway or a main area.
b. Use of a half wall or railing along at least one side of the room.
c. A conversation pit which interrupts the floor area.
d. (See DEH Guideline).

Building: A covered or uncovered structure including decks, steps, breezeways, covered patios, carports or similar structures.

Clay: The mineral soil particles less than 0.002 millimeter in diameter. As a USDA soil textural classification, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Cut or Embankment: Any altered area of land surface having a distinctly greater slope than the adjacent natural ground surface and any part of which is lower in elevation than the ground surface at the nearest point of the individual sewage disposal system. Cuts supported by retaining walls or similar structures shall be included within this definition.

Downslope Property Line: A property line of the subject property where the ground on the adjacent property slopes downward from that property line.

Drainfield: System of rock-filled trenches or beds that distribute treated sewage effluent for absorption into the soil (also "Leachfield", "Soil Absorption System.)"

Effective Drainfield Depth: The depth of drainrock below the bottom of the drainfield pipe.

Ephemeral Watercourse: A seasonal stream that flows for an extended period during and following a rainfall period. Ephemeral streams are dry for a significant portion of the year.

Groundwater: subsurface water that occurs beneath the water table or perched water table and the geologic formations or fill soils that are fully saturated.

Hardpan: A hardened or cemented soil horizon or layer. The soil material may be sandy or clayey and may be cemented by iron oxide, silica, calcium carbonate, or other substances.

Health Officer: The San Diego County Public Health Officer or an authorized representative.

Impermeable Layer: A soil or rock strata which may contain water but is incapable of transmitting significant quantities: for example, clay, hardpan and solid bedrock.

Linear Loading Rate: The linear loading rate is defined as the amount of effluent (gallons) applied per day per linear foot of the system (gpd/lf). The design linear loading rate is a function of effluent movement rate away from the system and the direction of movement away from the system (horizontal, vertical or combination).

Leachfield: See drainfield.

Percolation Test: The percolation test procedure according to DEH policy.

Perennial Watercourse: Any river, stream, or creek that can be expected to flow continuously or seasonally.

Sand: Individual rock or mineral fragments in soils having diameters ranging from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. As a USDA textural classification, a soil that contains 85 percent or more sand and not more than 10 percent clay.

Saturated Soil: The conditions of soil when all available pore space is occupied by water and the soil is unable to accept additional moisture.

Septic Tank: The septic tank separates solids from the liquid, digests organic matter and stores digested solids through a period of detention It allows the clarified liquids to discharge for final disposal.

Setback: The minimum horizontal distance from any point along the outside edge of a septic tank or the edge of a drainfield trench, mound, etc. to any point on the described site feature.

Shrinkage Crack: A crack produced in fine-grained sediment by the loss of contained water during drying or dehydration; e.g. a mud crack.

Silt: Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the USDA silt textural classification is 80 percent or more silt and less than 12 percent clay.

Soil: The unconsolidated material on the surface of the earth that exhibits properties and characteristics that are a product of the combined factors of parent material, climate, living organism, topography, and time.

Soil Depth: The combined thickness of adjacent soil layers that are suitable for effluent filtration. Soil depth is measured vertically to bedrock, hardpan or an impermeable soil layer.

Soil Horizon or Layer: A layer of a soil that is distinguishable from adjacent layers by characteristic physical properties such as structure, color, or texture, or by chemical composition, including content or organic matter or degree of acidity or alkalinity. Differences include, but are not limited to color, texture, pH, structure and porosity.

Soil Profile: A vertical section of a soil that displays all its horizons.

Soil Survey: A general term for the systematic examination of soils in the field and in the laboratory, their description and classification, the mapping of kinds of soil, and the interpretation of soils for many used, including suitability for growing various crops, grasses and trees, or for engineering uses, and predicting their behavior under different management systems.

Soil Texture: The relative proportions of sand, silt and clay as defined by the classes of the soil textural triangle (U.S. Department of Agriculture). The basic textural classes in order of increasing proportion of fine particles are sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay, and clay. Textural classes may be modified when coarse fragments are present in sufficient number, i.e. gravelly sandy loam or cobbly clay, or when the bulk density is excessive.
Soil Zone: Soil horizon.

Sump Chambers: Tanks which collect treated sewage for a period of time for pressured discharge to a leaching area or other onsite disposal system.

Topographic Map: A map showing the topographic features of a land surface, commonly by means of contour lines. It is generally on a sufficiently large scale to show in detail selected man-made and natural features, including relief and such physical and cultural features as vegetation, roads, and drainage.

Topography: The general configuration of a land surface, including its relief and the position of its natural and man-made features.

Unstable Landform: An area that shows evidence of mass downslope movement such as debris flow, landslides, rockfills, and hummocky hillslopes with undrained depressions upslope. Unstable landforms may exhibit slip surfaces roughly parallel to the hillside' landslide scars and curving debris ridges, fences, trees and telephone poles which appear tilted, or tree trunks which bend uniformly as they enter the ground. Active pond dunes are unstable land forms.

Watercourse: A definite open channel with bed and banks within which water flows either perennially, ephemerally, or intermittently including overflow channels contiguous to the main channel. A watercourse shall include both natural and man-made channels.